Particles and Fields in Modern Physics - M.L.G. Redhead

The object of the paper is to examine the metaphysical commitments of quantum field theory (QFT). Firstly the classical concept of field is analysed and contrasted with that of particle. A thesis of underdetermination as between field and particle approaches to classical mechanics is argued for. The situation in QFT is looked at and a number of controversial questions are posed:

1) Is there a formal underdetermination as between field and particle approaches to the elementary 'particles'?
2) Is the technical machinery of creation and annihilation operators used in QFT available also in classical mechanics?
3) Does QFT resolve the problem of wave-particle duality in quantum mechanics?
4) Does QFT allow a distinction between matter and force?
5) In what sense has QFT achieved unification in the theory of elementary particles?
6) Can indistinguishable particles in quantum mechanics be treated as individuals?
7) What is the nature of the vacuum in QFT?
8) What is the status of so-called virtual particles in QFT?

An attempt is made to answer all these questions and a new metaphysical category of ephemerals is introduced for the elementary 'particles', in the light of these answers.